INDOOR AIR QUALITY ASSESSMENT

Chelsea District Court
120 Broadway
Chelsea, Massachusetts

Prepared by:
Massachusetts Department of Public Health
Bureau of Environmental Health Assessment
Emergency Response/Indoor Air Quality Program
August 2003

Background/Introduction

At the request of Michael Jordan, Director of Court Capital Projects for the Administrative Office of the Trial Court (AOTC), the Massachusetts Department of Public Health (MDPH), Bureau of Environmental Health Assessment (BEHA) provided assistance and consultation regarding indoor air quality concerns at the Chelsea District Court, 120 Broadway, Chelsea, MA. Complaints of uneven temperature control prompted the inspection.

On May 21, 2003, a visit to conduct an indoor air quality assessment was made to the Chelsea District Court by Cory Holmes an Environmental Analyst in BEHA's Emergency Response/Indoor Air Quality (ER/IAQ) program. Mr. Holmes was accompanied by Robert Bash, Facility Manager, Chelsea District Court during the assessment.

The Chelsea District Court is a four story, brick building inclusive of a sub-basement, constructed in 2000. Windows are openable throughout the building.

Methods

Air tests for carbon dioxide, temperature and relative humidity were taken with the TSI, Q-Trak, IAQ Monitor, Model 8551.

Results

The Chelsea District Court has an employee population of approximately 80 and is visited by approximately 150-200 individuals daily. The tests were taken during normal operations. Test results appear in Table 1.

Discussion

Ventilation

It can be seen from the tables that carbon dioxide levels were elevated above 800 ppm (parts per million) in three of nineteen areas surveyed, indicating adequate ventilation in most areas of the building. Mechanical ventilation is supplied by eleven air-handling units (AHUs) that are located in mechanical rooms (Picture 1). Fresh air is drawn in through fresh air intakes on the exterior of the building (Picture 2) and delivered to occupied areas via ceiling-mounted air diffusers (Picture 3). Wall-mounted grills return air back to the AHUs via ductwork (Picture 4). Maintenance staff can control the system either locally or via a computerized workstation (Picture 5). AHUs are equipped with high-efficiency, pleated filters, which are reportedly changed three times a year. The interior of AHUs and filters were clean and free of accumulated debris.

To maximize air exchange, the BEHA recommends that both supply and exhaust ventilation operate continuously during periods of occupancy. In order to have proper ventilation with a mechanical supply and exhaust system, these systems must be balanced to provide an adequate amount of fresh air to the interior of a room while removing stale air. Mr. Bash reported that these systems were balanced in 2000. It is recommended that existing ventilation systems be re-balanced every five years to ensure adequate air systems function (SMACNA, 1994).

The Massachusetts Building Code requires a minimum ventilation rate of 20 cubic feet per minute (cfm) per occupant of fresh outside air or have openable windows in each room (SBBRS, 1997; BOCA, 1993). The ventilation must be on at all times that the room is occupied. Providing adequate fresh air ventilation with open windows and maintaining the temperature in

the comfort range during the cold weather season is impractical. Mechanical ventilation is usually required to provide adequate fresh air ventilation.

Carbon dioxide is not a problem in and of itself. It is used as an indicator of the adequacy of the fresh air ventilation. As carbon dioxide levels rise, it indicates that the ventilating system is malfunctioning or the design occupancy of the room is being exceeded. When this happens, a buildup of common indoor air pollutants can occur, leading to discomfort or health complaints. The Occupational Safety and Health Administration (OSHA) standard for carbon dioxide is 5,000 parts per million parts of air (ppm). Workers may be exposed to this level for 40 hours/week, based on a time-weighted average (OSHA, 1997).

The Department of Public Health uses a guideline of 800 ppm for publicly occupied buildings. A guideline of 600 ppm or less is preferred in schools due to the fact that the majority of occupants are young and considered to be a more sensitive population in the evaluation of environmental health status. Inadequate ventilation and/or elevated temperatures are major causes of complaints such as respiratory, eye, nose and throat irritation, lethargy and headaches. For more information concerning carbon dioxide, please refer to Appendix I.

Temperature readings ranged from 69^{o} F to 75^{o} F in occupied areas, which were very close to the BEHA recommended comfort guidelines. The BEHA recommends that indoor air temperatures be maintained in a range of 70^{o} F to 78^{o} F in order to provide for the comfort of building occupants. Temperature/poor airflow complaints were expressed in some areas, particularly in the first floor cubical areas. In many cases concerning indoor air quality, fluctuations of temperature in occupied spaces are typically experienced, even in a building with an adequate fresh air supply.

The relative humidity measured in the building ranged from 33 to 38 percent, which was below the BEHA recommended comfort range. The BEHA recommends a comfort range of 40 to 60 percent for indoor air relative humidity. Relative humidity levels in the building would be expected to drop during the winter months due to heating. The sensation of dryness and irritation is common in a low relative humidity environment. Low relative humidity is a very common problem during the heating season in the northeast part of the United States.

Microbial/Moisture Concerns

A number of areas had water coolers installed over carpeting. Water spillage or overflow of cooler catch basins can result in wetting of the carpet. In addition, some of the coolers had residue/build-up in the reservoir. Reservoirs are designed to catch excess water during operation and should be emptied/cleaned regularly to prevent microbial and/or bacterial growth.

Several areas had a number of plants. The plant in Picture 6 was on a cloth, which is a porous material conducive to mold growth, especially if wetted repeatedly. Moistened plant soil and drip pans can serve as a source of mold growth. Plants should be equipped with drip pans and located away from ventilation sources to prevent the aerosolization of dirt, pollen or mold.

Other Concerns

Mechanical exhaust ventilation in several restrooms was not functioning during the assessment. Mr. Bash reported that a replacement motor for restroom exhaust was on a work order to be installed. Exhaust ventilation is necessary in restrooms to remove moisture and to prevent restroom odors from penetrating into adjacent areas.

Of note was the amount of materials stored in workspaces. Items were observed on windowsills, tabletops, counters, bookcases and desks. The large number of items stored provides a source for dust to accumulate. These items (e.g. papers, folders, boxes) make it difficult for custodial staff to clean. Dust can be irritating to eyes, nose and respiratory tract. Items should be relocated and/or be cleaned periodically to avoid excessive dust build up.

Finally, a number of areas contained photocopiers. VOCs and ozone can be produced by photocopiers, particularly if the equipment is older and in frequent use. Ozone is a respiratory irritant (Schmidt Etkin, 1992). Photocopiers should be located near local exhaust ventilation or in well-ventilated areas (e.g. hallways).

Conclusions/Recommendations

In view of the findings at the time of this assessment, the following recommendations are made:

1. Continue working with HVAC contractor to remedy temperature/comfort problems. A coordinated effort should be made between occupant representatives, building liaisons/maintenance personnel and the HVAC contractor to resolve these issues.
2. Continue to make repairs to restore restroom exhaust ventilation.
3. Consider balancing mechanical ventilation systems, as recommended by ventilation industrial standards (SMACNA, 1994).
4. For buildings in New England, periods of low relative humidity during the winter are often unavoidable. Therefore, scrupulous cleaning practices should be adopted to minimize common indoor air contaminants whose irritant effects can be enhanced when the relative humidity is low. To control for dusts, a HEPA filter equipped vacuum

cleaner in conjunction with wet wiping of all surfaces is recommended. Drinking water during the day can help ease some symptoms associated with a dry environment (throat and sinus irritations).

5. Coordinated efforts among staff, building management and maintenance personal should be made to conduct cleaning of offices, common areas and cubicles/personal work spaces to prevent the accumulation of settled dust.
6. Ensure all plants are equipped with drip pans. Examine drip pans periodically for mold growth and disinfect with an appropriate antimicrobial where necessary.
7. Relocate or place tile or rubber matting underneath water coolers in carpeted areas.
8. Keep windows closed during hot, humid weather to maintain indoor temperatures and to avoid condensation problems.

References

BOCA. 1993. The BOCA National Mechanical Code-1993. 8th ed. Building Officials & Code Administrators International, Inc., Country Club Hills, IL. M-1601 et al.

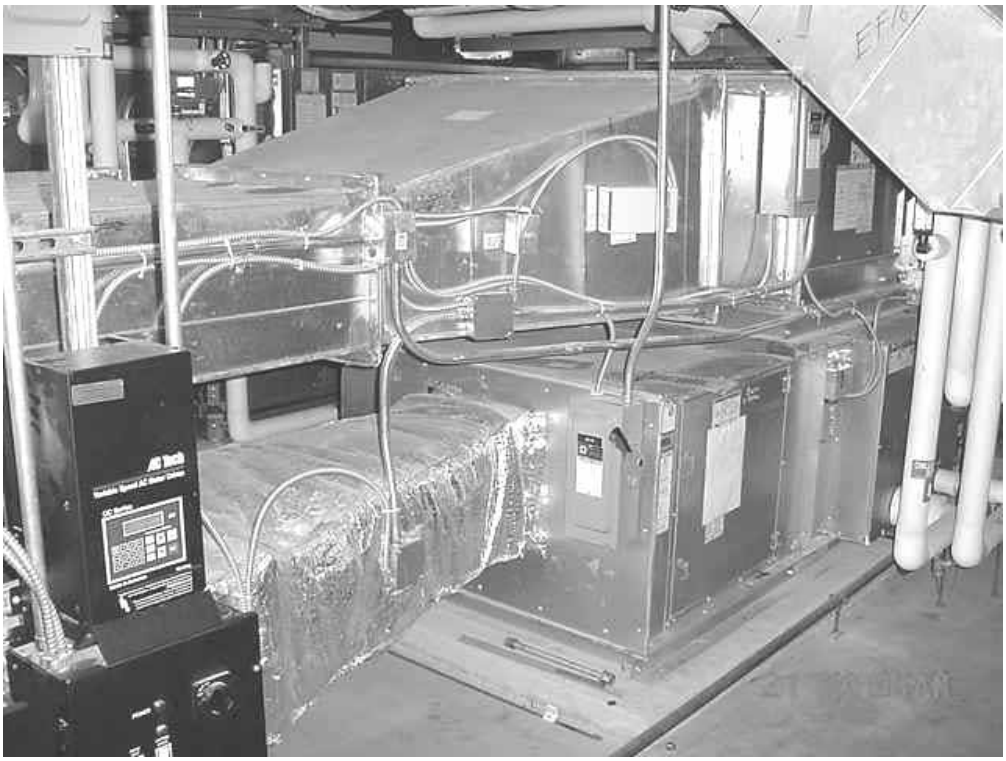
OSHA. 1997. Limits for Air Contaminants. Occupational Safety and Health Administration. Code of Federal Regulations. 29 C.F.R 1910.1000 Table Z-1-A.

SBBRS. 1997. Mechanical Ventilation. State Board of Building Regulations and Standards. Code of Massachusetts Regulations. 780 CMR 1209.0

Schmidt Etkin, D. 1992. Office Furnishings/Equipment & IAQ Health Impacts, Prevention & Mitigation. Cutter Information Corporation, Indoor Air Quality Update, Arlington, MA.

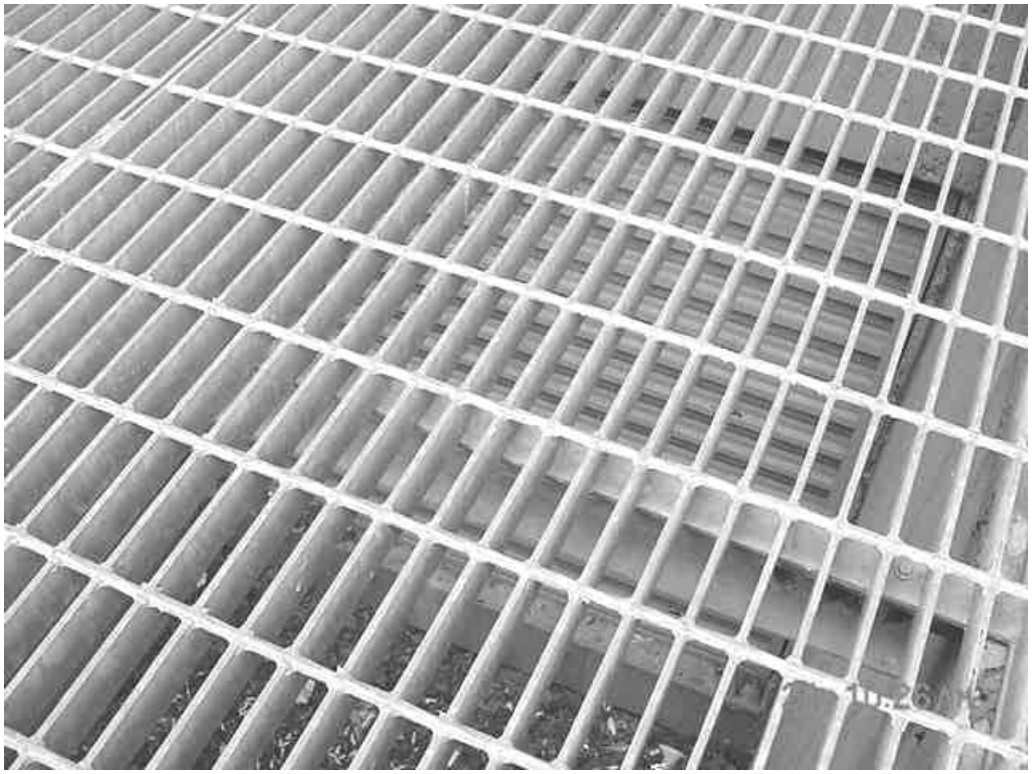
SMACNA. 1994. HVAC Systems Commissioning Manual. 1st ed. Sheet Metal and Air Conditioning Contractors' National Association, Inc., Chantilly, VA.

Picture 1



Air Handling Units and Local Controls

Picture 2



Fresh Air Intake for AHU

Picture 3

Ceiling-Mounted Air Diffuser

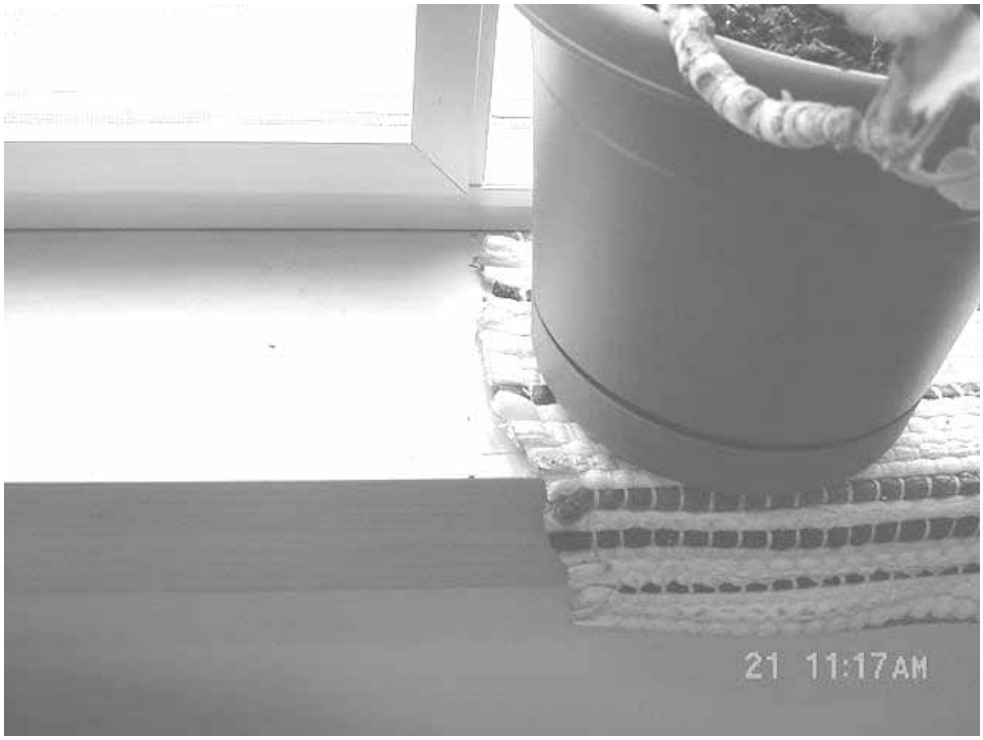
Picture 4

Return/Exhaust Grill

Picture 5

Computerized HVAC Control Station

Picture 6



Plant on Cloth on Windowsill

TABLE 1

Indoor Air Test Results – Chelsea District Court – Chelsea, Massachusetts May 21, 2003

Location	Carbon Dioxide (*ppm)	Temp. (°F)	Relative Humidity (%)	Occupants in Room	Windows Openable	Ventilation		Remarks
						Supply	Exhaust	
Outside (Background)	401	59	63					Overcast Winds 5 – 10 mph
Court Room 5	412	72	35	1	Y	Y	Y	
Jury Room 5	404	72	35	0	Y	Y	Y	
Men's Restroom					N	N	Y	
Women's Restroom					N	N	Y	
Jury Clerk	445	72	36	1	Y	Y	Y	
Men's Restroom Staff					N	N	Y	Exhaust off
Staff Lunch Room	413	72	36	0	Y	Y	Y	Window open
Women's Restroom 324							Y	Exhaust off
Jury Deliberation	456	72	36	0	Y	Y	Y	
3rd Floor Lockup	499	78	36	0	N	Y	Y	

ppm = parts per million parts of air
RR = restroom

Comfort Guidelines

Carbon Dioxide -	< 600 ppm = preferred
	600 - 800 ppm = acceptable
	> 800 ppm = indicative of ventilation problems
Temperature -	70 - 78 °F
Relative Humidity -	40 - 60%

TABLE 1

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Location	Carbon Dioxide (*ppm)	Temp. (°F)	Relative Humidity (%)	Occupants in Room	Windows Openable	Ventilation		Remarks
						Supply	Exhaust	
Jury Assembly 303	636	74	38	19	N	Y	Y	Water cooler on carpet
Women's and Men's Restrooms (304/305)					N	N	Y	
Women's Public Restroom					N	N	Y	
Court Room 4	926	75	38	44	Y	Y	Y	
218 Judge Lobby	465	74	33	0	Y	Y	Y	RR exhaust vent off
221 Judge Lobby	451	74	34	0	Y	Y	Y	RR exhaust vent off
214 Restroom					N	N	Y	
224 Judge Lobby	465	73	34	0	Y	Y	Y	RR vent off
231 Law Library	464	73	34	0	N	Y	Y	
233 Administrative	463	73	34	0	Y	Y	Y	
234 First Justice	466	73	34	0	Y	Y	Y	RR vent off

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						Supply	Exhaust	
Chief Court Officer	474	73	35	0	Y	Y	Y	Plants
243 Men's Restroom								
Court Room 2	485	72	35	5	N	Y	Y	
District Attorney's Office	574	74	35	4	N	Y	Y	Photocopier near thermostat
Room 204	577	74	35	0	N	Y	Y	
Chief DA's Office	560	74	34	1	N	Y	Y	Accumulated items
Room 206	593	74	35	1	N	Y	Y	
Court Room 3	563	72	33	2	Y	Y	Y	
Court Room 1	726	72	35	39	Y	Y	Y	
Juvenile Court	581	73	36	2	N	Y	Y	Water cooler on carpet Plants
Room 125	605	73	36	0	Y	Y	Y	

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						Supply	Exhaust	
Room 120	606	74	35	0	N	Y	Y	
Room 126	598	73	35	0	Y	Y	Y	
Room 127	697	73	35	1	Y	Y	Y	
Room 128	673	74	36	0	Y	Y	Y	
Clerk's cubicles (West Wing)	602	74	35	0	N	Y	Y	
Room 129	595	74	35	1	Y	Y	Y	Plants
Room 130	577	74	34	1	Y	Y	Y	
Room 131	585	74	34	0	N	Y	Y	
Room 132	574	74	34	0	Y	Y	Y	
Men's Restroom 117				0	N	N	Y	
Room 133	580	74	34	0				

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Room 134	650	73	34	0	Y	Y	Y	RR vent off
Women's Restroom 116								
Mail Room 110	631	74	35	0	N	Y	Y	2 refrigerators on carpet
Records 109	620	74	34	0	N	Y	Y	
Clerk's Cubicle Criminal Section	640	74	35	3	N	Y	Y	
Clerk's Cubicle Civil Section	670	74	35	3	N	Y	Y	Plants
Conference Room 106	655	73	35	0	N	Y	Y	Photocopier beneath exhaust vent/thermostat
Room 136	717	72	34	1	Y	Y	Y	
Room 137	690	72	35	1	Y	Y	Y	
Room 159	659	71	35	0	N	Y	Y	
Room 160	663	71	35	0	N	Y	Y	

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Room 139	660	70	35	0	N	Y	Y	
Room 140	632	70	35	0	Y	Y	Y	
Room 141	657	71	36	1	Y	Y	Y	
Room 142	635	69	36	0	Y	Y	Y	
Room 143	649	70	37	1	Y	Y	Y	
Room 153	672	70	38	0	N	Y	Y	
Room 152	663	70	37	0	N	Y	Y	
Room 144	673	70	37	0	Y	Y	Y	
Room 145	700	70	38	1	Y	Y	Y	`
Room 151	671	70	38	0	N	Y	Y	
Probation Restroom					N	Y	Y	Personal fan/dusty

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Probation Cubical East Probation	708	71	38	4	N	Y	Y	Plants
162 Records	699	71	38	2	N	Y	Y	Photocopier
Probation West	715	71	38	6	N	Y	Y	
Equipment Room 154	680	70	37	0	N	Y	Y	
Conference Room 138	722	70	37	2	Y	Y	Y	
Lockup Control Room	604	72	38	1	N	Y	Y	Video monitor equipment
Holding Cell 04	597	72	37	0	N	Y	Y	
Holding Cell 02	588		37	0	N	Y	Y	
Holding Cell 06	608	71	37	0	N	Y	Y	
Holding Cell 08	601	71	37	0	N	Y	Y	

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